

REMARKS/ARGUMENTS

Pending Claims

Claims 11-12, 14-17, 19-22 and 24-25 have been amended. Claims 13, 18 and 23 have been canceled. New claims 27-30 have been added. Accordingly, claims 11-12, 14-17, 19-22 and 24-30 are pending in this application. No new matter has been added. A Request for Continued Examination has been submitted with this paper so that the Examiner may fully consider the amendments and the following Remarks.

Amendments to the Specification

Minor informalities in the specification have been corrected, as shown above.

Claim Rejections under 35 U.S.C. §103

Claims 11-26 were rejected under 35 U.S.C. §103(a) as being unpatentable over Milligan et al., U.S. Patent No. 5,210,866 (hereafter "Milligan"), and further in view of Bachmat et al., U.S. Patent No. 6,237,063 (hereafter "Bachmat"). Applicants respectfully traverse these rejections, and request reconsideration and withdrawal of the rejections for the following reasons.

Applicants' invention is directed to data recovery in a computer system whereby data of a volume at a certain prior point in time may be restored (see Applicants' specification, e.g., at page 33, lines 4-5). The computer system includes a host computer and a storage system storing data accessed by the host computer. The

storage system includes a first physical storage area in one or more disks in the storage system and a controller accessing the one or more disks in the storage system. The first physical storage area corresponds to a first logical volume accessed by the host computer, and the host computer stores data in the first logical volume by storing the data to the first physical storage area. A backup copy of the data in the first logical volume is stored to tape at a certain point in time. After the certain point in time, upon occurrence of a failure in a sequence of processing executed by the host computer, the host selects an unused second logical volume in the storage system that corresponds to a second physical storage area of the one or more disks. The host reads the backup data from the tape to the second physical storage area thereby restoring a copy of the first logical volume at the certain point in time to the second logical volume (see, e.g., page 33, lines 9-13). The host instructs the controller to relate the second logical volume in the second physical storage area to the first logical volume in the first physical storage area according to a swap request by exchanging positional information of the second logical volume with positional information of the first logical volume, so that the controller accesses the second physical storage area when the controller receives an access request to the first logical volume from the host computer.

Milligan, on the other hand, is directed to an incremental disk backup system in which only tracks modified since a previous backup are backed up (see, e.g., col. 21, lines 13-54). The Office Action asserts that Milligan teaches restoration of data in a volume, citing col. 3, line 5, through col. 4, line 25. However, it is respectfully

submitted that all this portion of Milligan teaches is identifying a failed physical disk drive and switching a backup physical disk drive into the place of the failed physical disk drive (see col. 3, lines 57-60). Control circuitry then reconstructs the data stored on each physical track of the failed disk drive using the remaining N-1 physical tracks of data plus the associated M physical tracks containing redundancy segments of each logical track (see col. 3, lines 60-64). The reconstructed data is then written onto the substitute disk drive (see col. 3, lines 67-68). Thus, Milligan teaches only reconstructing the data on a failed drive using redundancy data from other drives in the redundancy group. Milligan defines a redundancy group as a logical volume (see, e.g., col. 11, lines 66-67). Thus, at best, Milligan is reconstructing data of only a portion of a logical volume, and the reconstruction that is taking place is of the current data, not a point in time backup copy of the volume.

It is respectfully submitted that Milligan's process bears little similarity to Applicants' invention, in which data of a logical volume at a certain point in time is able to be recovered from a backup copy of the logical volume stored on a tape. When a failure occurs during processing in a first logical volume made up of a first physical storage area, under Applicants' invention, data of the first volume may be restored to a past point in time, and the processing may then be restarted at that point in time. Accordingly, when it is necessary to restore the first volume to a past point in time, the host selects an unused second volume made up of a second physical storage area, and copies the backup copy of the data from the tape to the second volume to create a backup copy of the first volume at the certain point in time. The host then issues a

swap instruction that instructs the storage system to exchange positional information for the first volume with the second volume, so that access requests to the first volume are directed to the second volume and/or the second physical storage area. Thus, unlike Milligan, Applicants' invention does not require the use of a substitute disk drive, and Applicants' invention does not relate to reconstructing current data using redundancy information. Instead, Applicants' invention is directed restoring data in a volume to a specified point in time by swapping positional or mapping information with a restored backup volume, which is neither taught nor suggested by Milligan, Bachmat, or the other art of record.

Bachmat was cited in combination with Milligan as teaching continuous logical tracks. The limitations relating to continuous logical tracks have been deleted from the claims, and, accordingly, it is believed that Bachmat is no longer applicable to the claims of the application.

Further, in the rejections of claims 13, 18, and 23, the Office Action asserts that Milligan teaches that backup data stored on a tape medium is stored from the tape to the second physical storage area of the second volume, citing col. 8, line 40, to col. 9, line 20 and FIG. 1 of Milligan. However, all that this portion of Milligan teaches is a tape drive control unit interface for connecting a tape drive control unit to the storage system. It is respectfully submitted that Milligan teaches nothing regarding restoring data from a tape to an unused volume in the storage system, or swapping positional information of the restored volume with the original volume to complete the restore

process. The subject matter of claims 13, 18 and 23 has been incorporated into the independent claims, and claims 13, 18 and 23 have been canceled.

New claim 27 includes the limitations that a point in time backup copy of a first logical volume is copied from a backup device to a second logical volume, and mapping information of first logical areas of the first logical volume is interchanged with mapping information of second logical areas of the second logical volume so that the first logical areas of the first logical volume map to the second physical storage areas, wherein when the host accesses the first logical areas of the first logical volume, the second physical storage areas are accessed. As discussed above, Milligan does not teach copying data from a backup device to a second logical volume and then interchanging mapping information for first logical areas of the first logical volume with mapping information for second logical areas of the second logical volume. Accordingly, claim 27 is allowable over the teachings of Milligan.

Further, it is noted that claim 24 and new dependent claim 30 are directed to an aspect of the invention in which only a portion of the positional or mapping information is exchanged from the second volume to the first volume. Thus, an access request to one part of the first logical volume might be directed to the second physical storage areas, while an access request to another part of the first logical volume might be directed to the first physical storage areas (see, e.g., Applicants' specification at page 36, line 19 through page 37, line 19). It is respectfully submitted that Milligan provides no teaching of this aspect. Accordingly, claims 24 and 30 are allowable over Milligan

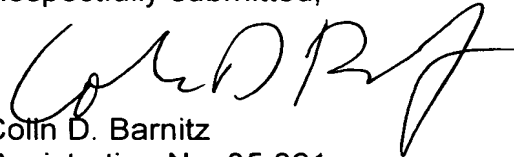
and the other art of record for this aspect, in addition to the other reasons set forth above.

Thus, for the reasons discussed above, it is respectfully submitted that independent claims 11, 16, 21, 24 and 27 are allowable over Milligan, Bachmat and the other art of record, whether taken singly, or in combination. The remaining claims depend from these claims, are directed to additional patentable features, and are allowable at least because they depend from allowable base claims.

Conclusion

In view of the foregoing, Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Colin D. Barnitz', written in a cursive style.

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